

*What is claimed is:*

- 5 *Sub A1*
1. A method of information structuring in a data set containing a plurality of interrelated objects, comprising:  
ranking related objects based upon relationship strength;  
clustering related objects; and  
computing the number of affinity charts per object.
  - 10 2. A method, as in claim 1, wherein said ranking step further comprises:  
for each related object to a selected object, calculating an affinity value between each of said related objects and said selected object based upon one or more criteria; and  
ordering each of said related objects in said data set according to said affinity value between said related object and said selected object.
  - 15 3. A method, as in claim 2, wherein said one or more criteria includes an objective measurement.
  - 20 4. A method, as in claim 2, wherein said one or more criteria includes a subjective measurement.
  - 25 5. A method of generating a graphical layout, comprising:  
selecting a principal node for said graphical layout;  
generating at least one affinity chart in connection with said principal node;

25 and

sequentially establishing related items along the at least one affinity chart by rank.

6. A method, as in claim 5, wherein said at least one affinity chart further comprises an affinity curve.

7. A method, as in claim 5, wherein said at least one affinity chart further comprises a list of related items.

10 8. The method according to claim 5 further comprising the step of positioning the selected principal node at a prominent location in said graphical layout.

9. The method according to claim 5 wherein for each related item in an affinity chart the size of the item is computed.

15 10. The method according to claim 6 wherein gradients are used to suggest item affinity level.

20 11. The method according to claim 10, wherein said gradient further comprises a color gradient.

12. The method according to claim 10, wherein said gradient further comprises a size gradient.

13. The method according to claim 6 wherein provision is made to allow a sufficient vertical and horizontal displacement interval to prevent overlap of related items.

5 14. A method of information linking, comprising:  
hyperlinking related graphs of visualizable large interrelated data sets; and  
navigating between hyperlinked related graphs.

10 15. A method for providing visualization of items from data sets, the method comprising:

determining, for a plurality of items from said data set, a set of properties, said set of properties including a relationship to each other of the subsets of items in the data set, and a value applied to the relationships between the items;

15 applying local rankings of the relationships between terms, by ranking items i that relate to each item j, and ranking all items k to which item j relates, thereby ranking the affinity of each item j to item sets i and k;

generating a visualization by presenting results separately for each item in a data set and adjusting the presentation to avoid information overlap and overload; and

20 providing separate presentation for each item of the data set by generating an affinity chart for each item j in the data set, thereby displaying items closely related to selected item j, with item j placed prominently in the affinity chart, and placing items which are more strongly related to j closer to j.

25 16. The method of claim 15, further comprising the step of expressing closeness along shaped segments, emanating from j's position.

17. A method as in claim 16, wherein said shaped segments further comprise curved segments.

5 18. The method of claim 15, further comprising:

employing continuous curves including spiral segments, in order to connect items relating to a item (j) at different intensity levels;

adjusting the visualization to avoid information overlap and overload, the items related to item (j) grouped by strength of affinity;

10 providing an affinity chart, and spacing each related item individually with each item placed in a non-overlapping position;

presenting items with large numbers of related items with multiple affinity charts, and in the case of multiple affinity charts, providing a first affinity chart to visually represent a set of most strongly related items and providing next or

15 subsequent related affinity charts to visually represent less strongly related items;

using curves to represent a relationship of items related to a particular item positioned at a starting point for the curve, with distance along the curve representing a strength of an affinity to the item at the starting point of the curve; and

20 selectively employing color and shading gradations and curve thickness gradations are to emphasize the curve's role in conveying affinity strength, while placing items so they do not overlap or crowd each other.

19. A method for providing visualization of data sets containing a large number of items from said data sets, the method comprising:

employing continuous curves including spiral segments, in order to connect items relating to a primary item at different intensity levels;

adjusting the visualization to avoid information overlap and overload, the items related to said primary item grouped by strength of affinity;

5 providing an affinity chart, and spacing each related item individually with each item placed in a non-overlapping position;

presenting items with large numbers of related items with multiple affinity charts, and in the case of multiple affinity charts, providing a first affinity chart to visually represent a set of most strongly related items and providing next or  
10 subsequent related affinity charts to visually represent less strongly related items;

using curves to represent a relationship of items related to a particular item positioned at a starting point for the curve, with distance along the curve representing a strength of an affinity to the item at the starting point of the curve; and

selectively employing color and shading gradations and curve thickness  
15 gradations are to emphasize the curve's role in conveying affinity strength, while placing items so they do not overlap or crowd each other.

20. A method for providing visualization of arbitrarily large data sets using low and local computational resources, the method comprising:

20 determining, for at least a plurality of said data sets, a set of properties, said set of properties including a relationship to each other of the subsets of items in the data set, and a value applied to the relationships between the items;

determining at least one primary item for the visualization;

applying local rankings of the relationships between terms, by ranking a first  
25 relational set of items that relate to the primary item, and ranking a second relational

set of items to which the primary item relates, thereby ranking the affinity to each primary item to the first relations set of items and to the second relational set of items;

generating a visualization by presenting results separately for each item in a predetermined data set and adjusting the presentation to avoid information overlap and

5 overload;

providing separate presentation for each item of the data set by generating an affinity chart for each primary item in the data set, thereby displaying items closely related to a selected primary item, with the primary item placed prominently in the affinity chart, and placing items which are more strongly related to the primary item

10 closer to the primary item;

expressing closeness along curves or shaped segments, connected or emanating from the primary item's position;

said expression of closeness including completely or partially straight shaped segments;

15 employing continuous curves including spiral segments, in order to connect items relating to a primary item at different intensity levels;

adjusting the visualization to avoid information overlap and overload, the items related to the primary item grouped by strength of affinity;

20 providing an affinity chart, and spacing each related item individually with each item placed in a non-overlapping position;

presenting items with large numbers of related items with multiple affinity charts, and in the case of multiple affinity charts, providing a first affinity chart to visually represent a set of most strongly related items and providing next or subsequent related affinity charts to visually represent less strongly related items;

using curves to represent a relationship of items related to a particular item positioned at a starting point for the curve, with distance along the curve representing a strength of an affinity to the item at the starting point of the curve; and

selectively employing color and shading gradations and curve thickness

5 gradations are to emphasize the curve's role in conveying affinity strength, while placing items so they do not overlap or crowd each other.

21. A method for providing visualization of large interrelated data sets, the method comprising:

10 determining a relationship strength of related items in a data set;

for each item in the data set, ranking related items based on the relationship strength;

clustering related items based on said ranking;

computing a number of affinity charts per item;

15 establishing clusters of related items;

repeating the steps of ranking related items based on the relationship strength and computing the affinity charts until a desired information structure is achieved;

positioning a principal node prominently in the affinity chart; and

generating entries in said affinity chart emanating from the principal node for

20 each of said clusters of related items.

22. A method as in claim 21, wherein said step of generating entries in said affinity chart further comprises laying out graphs of one per cluster of related items.

25 23. A method as in claim 21, wherein said step of generating entries in said

affinity chart further comprises populating a list of related items.

24. A chart server for creating a graphical layout of a visualization of an interrelated data set, comprising:

- 5 means for selecting a principal node for said graphical layout;
- means for generating at least one affinity curve from an affinity chart in connection with said principal node;
- means for sequentially establishing related items along the at least one affinity curve by rank;
- 10 means for linking related affinity charts of interrelated data sets; and
- means for navigating between linked related affinity charts.

25. An affinity server for structuring information for use in visualization of a large interrelated data set, comprising:

- 15 means for ranking related objects based upon relationship strength;
- means for clustering related objects; and
- means for computing the number of affinity charts per object.

26. A computer readable medium containing computer program instructions for providing visualization of items from data sets, said computer program instructions containing instructions for:

determining, for at least a plurality of said data sets, a set of properties, said set of properties including a relationship to each other of the subsets of items in the data set, and a value applied to the relationships between the items;



applying local rankings of the relationships between terms, by ranking items  $i$  that relate to each item  $j$ , and ranking all items  $k$  to which item  $j$  relates, thereby ranking the affinity to each item  $j$  to item sets  $i$  and  $k$ ;

generating a visualization by presenting results separately for each item in a  
5 predetermined data set and adjusting the presentation to avoid information overlap and overload; and

providing separate presentation for each item of the data set by generating an affinity chart for each item  $j$  in the data set, thereby displaying items closely related to selected item  $j$ , with item  $j$  placed prominently in the affinity chart, and placing items  
10 which are more strongly related to  $j$  closer to  $j$ .

27. A system for providing visualization of items from data sets at a first computer operably coupled to a second computer over a communications network, comprising:

a computerized server associated with said second computer, said  
15 computerized server including data set visualization software executable on said computerized server and configured to:

determine, for a plurality of said data sets, a set of properties, said set of properties including a relationship to each other of the subsets of items in the data set, and a value applied to the relationships between the items;

20 apply local rankings of the relationships between terms, by ranking items  $i$  that relate to each item  $j$ , and ranking all items  $k$  to which item  $j$  relates, thereby ranking the affinity of each item  $j$  to item sets  $i$  and  $k$ ;

generate a visualization by presenting results separately for each item in a data set and adjusting the presentation to avoid information overlap and overload; and

25 providing separate presentation for each item of the data set by generating an

affinity chart for each item  $j$  in the data set, thereby displaying items closely related to selected item  $j$ , with item  $j$  placed prominently in the affinity chart, and placing items which are more strongly related to  $j$  closer to  $j$ .